

## REMARKS

Claims 1-23 are pending in the present Application.

Reconsideration and allowance of the claims are respectfully requested in view of the following remarks.

### Claim Rejections Under 35 U.S.C. § 112, First Paragraph

Claims 1-23 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the Specification in such a way as to reasonably convey to one skilled in relevant art that the inventors, at the time the Specification was filed, had possession of the claimed invention. (Office Action dated 6/28/2008, page 2) In particular, the Examiner stated “the added limitation to claim 1 and other claims of means for inducing selective precipitation excluding adsorption to a template are considered to not be supported by the Specification as originally filed and constitute new matter.” (Office Action dated 6/28/2008, page 2) Applicants respectfully traverse this rejection.

In the Amendment and Response filed on March 15, 2007, Applicants noted that support for these amendments can be found at least at Examples 2-6, and throughout the specification as filed. Examples 2-6 each provide descriptions of method for bulk separation of single wall nanotubes (SWNTs) according to type (metallic (*met-*) vs. semiconducting (*sem-*)) and diameter. None of the Examples describe, nor does the specification as a whole describe methods that use a template for adsorbing SWNT as a means to separate *met*-SWNT from *sem*-SWNT.

In the Amendment and Response filed on March 15, 2007, Applicants also provided detailed arguments, citing the MPEP and case law, asserting that (1) literal basis in the specification for a negative limitation is not required and (2) one of ordinary skill in the art, upon reading the entire specification, would readily understand that the claimed invention is directed to methods of separating *met*-SWNT from *sem*-SWNT “without adsorption to a template” and (3) Applicants had possession of the concept of what is claimed. Applicants respectfully note that although the Examiner asserts that the limitation is not supported by the specification, the Examiner has not responded to Applicants detailed arguments provided in the Amendment and Response filed on March 15, 2007. Since the Examiner has not responded to

Applicants previous arguments, as required by MPEP § 2163(III)(B), Applicants respectfully maintain the following arguments.

While there is no *in haec verba* requirement, newly added claim limitations must be supported in the specification through express, **implicit, or inherent disclosure**.

(MPEP § 2163(I)(B), emphasis added)

Applicants respectfully assert that although the language “without adsorption to a template” is not present in the specification *ipsis verbis*, such is not required if the originally-filed disclosure would have conveyed to one having ordinary skill in the art that the inventor had possession of the concept of what is claimed. The specification, when describing the claimed composition, does not suggest methods of separating *met*-SWNT from *sem*-SWNT using a template, hence leading the skilled artisan to understand that the using a template to separate *met*-SWNT from *sem*-SWNT was not contemplated. Therefore the implied limitation present by omission can be explicitly stated. Furthermore, the examples of the pending application, which do not describe methods that use a template for adsorbing SWNT as a means to separate *met*-SWNT from *sem*-SWNT, provide ample support for the amended claims. It is here noted that MPEP 2173.05(i) provides an explanation as to the use of negative limitations. This section provides:

Any negative limitation or exclusionary proviso must have basis in the original disclosure. \*\*\* Note that a lack of literal basis in the specification for a negative limitation may not be sufficient to establish a *prima facie* case for lack of descriptive support. *Ex parte Parks*, 20 U.S.P.Q.2d 1234, 1236 (Bd. Pat. App. & Inter. 1193).

(Emphasis added) In *Ex parte Parks*, the Examiner had rejected the limitation “in the absence of a catalyst” because there was no literal statement in the specification to support the limitation. The Board held that “literal support does not, in and of itself, establish a *prima facie* case for lack of adequate descriptive support under the first paragraph of 35 U.S.C. 112.” *Id.* The Board also held that “**it is sufficient if the originally-filed disclosure would have conveyed to one having ordinary skill in the art that an appellant had possession of the concept of what is claimed.**” *Id.* In footnote 3, the Board points out that “whether the requirement for an adequate written description has been met is a question of fact and, hence, driven by the exigencies of each case.”

Moreover, the Board of Patent Appeals & Interferences has consistently held that the specification does not require a literal statement supporting a negative limitation. In *Ex parte Kenneth E. Starling Jr., and Brian J. Love*, 1995 WL 1696871, \*2 (Bd. Pat. App. & Inter. 1995), the claim language at issue was “curable without the application of any supplemental heat.” The Board held that “Although the disclosure is silent as to the use of heat, **it can reasonably be said that appellants’ silence would have disclosed to one of ordinary skill in the art** that the dental adhesive would have been “curable in the absence of heat.” *Id.*; emphasis supplied. Thus, while Applicants’ specification does not literally state Applicants’ negative limitation as recited in Claims 1 and 20, 35 USC 112, first paragraph, does not require a literal statement in the specification. One of ordinary skill in the art, upon reading the entire specification, would readily understand that the the claimed invention is directed to methods of separating *met*-SWNT from *sem*-SWNT “without adsorption to a template”.

Here, the originally filed disclosure would have conveyed to one having ordinary skill in the art that the Applicant had possession of the concept of what is claimed, in that an ordinary person skilled in the art would have understood that the invention is directed to methods of separating *met*-SWNT from *sem*-SWNT “without adsorption to a template.” Note that the specification does not disclose any method of separating *met*-SWNT from *sem*-SWNT with the use of a template. None of the Examples 2-6 use a template. Thus, Applicants believe that the disclosure provides clear antecedent basis for methods of separating *met*-SWNT from *sem*-SWNT “without adsorption to a template.”

In making the rejection the Examiner has asserted that the specification as filed does not disclose methods of separating *met*-SWNT from *sem*-SWNT “without adsorption to a template.” Applicants respectfully point out that there is no mention of separating *met*-SWNT from *sem*-SWNT using a template and that Examples 2-6 clearly teach methods of separating *met*-SWNT from *sem*-SWNT “without adsorption to a template.”

No new matter was introduced by the limitation to “without adsorption to a template”, since the application as a whole and the Examples in particular teach this embodiment. “[M]atter added that makes explicit that which was implicit, inherent, or intrinsic in the original

disclosure is not new matter and is permitted.” 35 U.S.C. § 132. Furthermore, “conformation of one part of the disclosure to another portion thereof is clearly permissible.” 37 C.F. R. § 1.117. Since Applicants have disclosed Examples describing methods of separating *met*-SWNT from *sem*-SWNT wherein “without adsorption to a template” is inherent, Applicants are permitted to later amend the Application to recite the inherent feature without introducing new matter. *In re Smythe and Shamos*, 178 U.S.P.Q. 279, 285-286 (C.C.P.A. 1973).

Reconsideration and withdrawal of this rejection are respectfully requested.

#### Claim Rejections Under 35 U.S.C. § 102(b)

Claims 1-4, 9-13, and 19-23 stand rejected under 35 U.S.C. § 102(b), as allegedly anticipated by Holzinger et al. (Angew. Chem. Int. Ed. 2001, Vol. 40, No. 21, @WILEY-VCH Verlag-GmbH, D-69451, Weinheim 2001, pp. 4002-4005)(hereinafter “Holzinger”). Applicants respectfully traverse this rejection.

Independent Claim 1 is directed to a method of separating *met*-SWNTs from *sem*-SWNTs comprising suspending a population of functionalized SWNTs in a suspending solvent, and employing a means for inducing selective precipitation without adsorption to a template, wherein selective precipitation comprises precipitating a majority of the *met*-SWNTs while leaving a population of the *sem*-SWNTs in suspension, or precipitating a majority of the *sem*-SWNTs while leaving a population of the *met*-SWNTs in suspension.

Independent claim 19 is directed to method of separating *sem*-SWNTs or *met*-SWNTs by diameter to form a diameter-separated population of *sem*-SWNTs or *met* SWNTs, comprising suspending an enriched population of functionalized *sem*-SWNTs or an enriched population functionalized *met*-SWNTs in a suspending solvent to form a functionalized *sem*-SWNT suspension or a functionalized *met*-SWNT suspension, and employing a means for selectively precipitating according to diameter the functionalized *sem*-SWNTs or functionalized *met*-SWNTs without adsorption to a template, wherein the enriched population of functionalized *sem*-SWNTs comprises greater than or equal to about 66 wt% *sem*-SWNTs or the enriched population of functionalized *met*-SWNTs comprises greater than or equal to about 66 wt% *met*-SWNTs.

To anticipate a claim, a reference must disclose each and every element of the claim.

*Lewmar Marine v. Variant Inc.*, 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987). The Applicant contends that Holzinger does not anticipate independent claims 1 and 14 because Holzinger fails to disclose at least the feature of **separating *met*-SWNTs from *sem*-SWNTs** by selective precipitation. The Applicant, after thoroughly studying Holzinger, cannot find any disclosure of the selective precipitation of SWNTs by type (i.e., *met*-SWNTs and *sem*-SWNTs)

Holzinger is generally directed to covalent sidewall functionalization of SWNTs. Specifically, Holzinger discusses three types of reaction by for direct addition to the unsaturated  $\pi$ -electron systems of the nanotubes: 1) the [2+1] cycloaddition of nitrenes; 2) the addition of nucleophilic carbenes; and 3) the addition of radicals. The paragraph bridging the 1<sup>st</sup> and 2<sup>nd</sup> columns of page 4002 discusses 1) the [2+1] cycloaddition of nitrenes. This paragraph teaches that nitrene derivatized SWNTs are soluble in DMSO, which allowed their separation from insoluble contaminants such as non-nitrene derivatized SWNTs. However, contrary to the Examiners assertion, paragraph bridging the 1<sup>st</sup> and 2<sup>nd</sup> columns of page 4002 does not teach **selective separating *met*-SWNTs from *sem*-SWNTs**. Rather, this paragraph teaches the effective **suspension** of SWNTs which been derivatized by covalent sidewall functionalization.

The paragraph bridging the 2<sup>nd</sup> column of page 4002 and the 1<sup>st</sup> column 1 on page 4003 discusses precipitating functionalized SWNTs following the 2) the addition of nucleophilic carbenes. Here, Holzinger teaches that SWNTs derivatized via nucleophilic carbenes are soluble in DMSO. Holzinger teaches that this property permitted the separation of the DMSO-insoluble starting and insufficiently functionalized SWNTs from the carbene-derivatized SWNTs by centrifugation. As above, this paragraph teaches the effective **suspension** of SWNTs which been derivatized by covalent sidewall functionalization.

Thus, the paragraph bridging the 2<sup>nd</sup> column of page 4002 and the 1<sup>st</sup> column 1 on page 4003 does not teach **selective separating *met*-SWNTs from *sem*-SWNTs**. Rather, these paragraphs, and the entire disclosure of Holzinger merely teaches the effective **suspension** of SWNTs which been derivatized by covalent sidewall functionalization.

In summary, Applicant respectfully assert that Holzinger does not teach separating *met*-SWNTs from *sem*-SWNTs by selective precipitation, wherein selective precipitation comprises precipitating a majority of the *met*-SWNTs while leaving a population of the *sem*-SWNTs in

suspension, or precipitating a majority of the *sem*-SWNTs while leaving a population of the *met*-SWNTs in suspension. For this reason at least, Holzinger does not teach all elements of the claimed invention. Since Holzinger does not teach all elements of the claimed invention it cannot anticipate claims 1-4, 9-13 and 19-23 under § 102(b). Applicant respectfully request reconsideration and withdrawal of the rejection of claims 1-4, 9-13 and 19-23.

#### Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-23 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Schleier-Smith et al. (US 6,669,918) (hereinafter “Schleier-Smith”) in view of Haddon et al (US 6,187,823) and Haddon et al. (US 6,368,569) (discusses hereinafter as “the Haddon patents”). Applicants respectfully traverse this rejection.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). The obviousness inquiry also requires consideration of common knowledge and common sense. *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1742-43 (2007); *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1367 (Fed. Cir. 2006) (“Our suggestion test is in actuality quite flexible and not only permits, but requires, consideration of common knowledge and common sense.”)

Independent claims 1, 14, and 19 are directed to a method of separating *met*-SWNTs from *sem*-SWNTs without adsorption to a template. Schleier-Smith, on the other hand, requires use of a template in separating SWNTs. As acknowledged by the Examiner:

Schleier-Smith et al ‘918 discloses suspending a population of mixed single wall nanotubes (SWNT) . . . , followed by separation steps to separate the types of SWNT, including a type of selective precipitation of met or sem SWNT, concerning deposition of nanotubes [having] a selected chirality corresponding to

the chirality of either semiconduction or metallic nanotubes, on a template (column 3, lines 24-34 and column 4, lines 62-column 5, line 4).

(Office Action dated 8/16/2006, page 3, emphasis added)

Schleier-Smith itself states that it is directed to “a method for bulk separation of single-walled tubular fullerenes utilizing a template for adsorbing single-walled tubular fullerenes of a predetermined chirality.” (Col. 1, ll. 10-13, emphasis added) As stated in the Abstract as well as numerous times throughout Schleier-Smith, the template is exposed to a suspension of single walled tubular fullerenes of random chiralities for adsorption of single walled tubular fullerenes of the selected chirality into the openings of the template. (Abstract; col. 2, ll. 17-34) The method disclosed by Schleier-Smith is summarized as follows:

A method for bulk separation of single-walled tubular fullerenes (100) based on chirality is provided wherein a first step is the formation of a template (40) on a crystalline substrate (30). The template (40) has a plurality of openings (32) which are oriented to energetically favor adsorption of a respective plurality of single-walled fullerenes (100) having a tubular contour and a selected chirality. Next, the template (40) is exposed to a suspension (16) of single-walled tubular fullerenes (100) of random chiralities for adsorption of single-walled tubular fullerenes (100) of the selected chirality into the openings (32) of template (40). Then, the template (40) is removed from exposure to the suspension (16) and the adsorbed single-walled tubular fullerenes (100) of the selected chirality are removed from the template (40). The template (40) may then be reused to adsorb further tubular fullerenes (100) of the selected chirality from a suspension (16) of tubular fullerenes (100) of random chiralities.

(Abstract)

Schleier-Smith thus does not disclose or suggest any method of separating *met*-SWNTs from *sem*-SWNTs without adsorption to a template, or a method for selective extraction of *sem*-SWNTs from a mixture of *sem*-SWNTs and *met*-SWNTs without adsorption to a template. Independent Claims 1, 14 and 19 positively exclude utilizing a template for adsorbing SWNTs. Further, Schleier-Smith does not disclose selective **precipitation**. Rather, Schleier-Smith teaches selective **adsorption** of “single-walled tubular fullerenes (100) of random chiralities . into the openings (32) of template (40)” (Abstract). For these reasons at least, Schleier-Smith does not disclose or suggest all of the limitations of the present claims.

The Haddon patents fail to remedy this deficiency. Specifically, the Haddon patents fail to compensate for the deficiencies of Schleier-Smith. The Haddon patents are directed to methods

for solubilizing carbon nanotubes. (Abstract) While the Haddon patents disclose the separation of single walled carbon nanotubes from impurities (e.g., metal catalysts, nanoparticles, graphite, amorphous carbon, fullerenes, and other contaminants) ('823 patent, col. 3, ll. 59-65), the Haddon patents do not disclose or suggest separation of the different types of single walled carbon nanotubes from each other according to type (metallic (*met*-) vs. semiconducting (*sem*-)) and diameter. In fact, the Haddon patents focus only on the solubilization of single walled carbon nanotubes in general, and fail to distinguish between the different types of single walled carbon nanotubes altogether.

The Haddon patents certainly do not disclose a method of separating *met*-SWNTs from *sem*-SWNTs, or a method for selective extraction of *sem*-SWNTs from a mixture of *sem*-SWNTs and *met*-SWNTs, without adsorption to a template. Thus, the Haddon patents and, individually or in combination, do not disclose all of the elements of the claimed invention.

It is further believed that neither Schleier-Smith nor the Haddon patents, alone or in combination, suggest the separation methods as presently claimed. In the present application, the Applicants disclose novel method to separate SWNTs according to type (semiconducting vs. metallic) and diameter. Such separation is not based on preparation and use of a template; rather it is based on the differential redox behavior of *met*- vs. *sem*-SWNTs to the redox equilibrium. Applicant recognized that this differential redox behavior could be exploited to allow separation *met*- vs. *sem*-SWNTs using different techniques, as discussed in detail in Applicant's Amendment and Response filed February 15, 2007.

In summary, the Applicant believes that the combination of Schleier-Smith with the Haddon patents do not teach or suggest the foregoing separations. Therefore, Applicant believes that a *prima facie* case of obviousness has not been made against claims 1, 14 and 19, as well as those claims that depend therefrom. Applicant respectfully request reconsideration and withdrawal of the rejection applied to Claims 1-23 under 35 U.S.C. § 103(a) and an allowance of the claims.

Claims 5-8 and 14-18 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Holzinger in view of the Haddon patents. Applicants respectfully traverse



this rejection.

As discussed in detail above, Holzinger does not teach separating *met*-SWNTs from *sem*-SWNTs by selective precipitation, wherein selective precipitation comprises precipitating a majority of the *met*-SWNTs while leaving a population of the *sem*-SWNTs in suspension, or precipitating a majority of the *sem*-SWNTs while leaving a population of the *met*-SWNTs in suspension. Nor does Schleier-Smith disclose selective **precipitation**. Rather, the general disclosure of Holzinger teaches the effective **suspension** of SWNTs which been derivatized by covalent sidewall functionalization. Holzinger does not teach, or even consider, separating *met*-SWNTs from *sem*-SWNTs. For these reasons at least, Holzinger does not teach all elements of the claimed invention. The Haddon patents do not make up for the deficiencies of Holzinger.

The Haddon patents are directed to methods for solubilizing carbon nanotubes. (Abstract) While the Haddon patents disclose the separation of single walled carbon nanotubes from impurities (e.g., metal catalysts, nanoparticles, graphite, amorphous carbon, fullerenes, and other contaminants) ('823 patent, col. 3, ll. 59-65), the Haddon patents do not disclose or suggest separation of the different types of single walled carbon nanotubes from each other according to type (metallic (*met*-) vs. semiconducting (*sem*-)) and diameter. In fact, the Haddon patents focus only on the solubilization of single walled carbon nanotubes in general, and fail to distinguish between the different types of single walled carbon nanotubes altogether.

The Haddon patents certainly do not disclose a method of separating *met*-SWNTs from *sem*-SWNTs, or a method for selective extraction of *sem*-SWNTs from a mixture of *sem*-SWNTs and *met*-SWNTs, without adsorption to a template. Thus, the Haddon patents and, individually or in combination, do not disclose all of the elements of the claimed invention.

In summary, Applicant respectfully assert that the combination of Holzinger and the Haddon patents does not teach separating *met*-SWNTs from *sem*-SWNTs by selective precipitation, wherein selective precipitation comprises precipitating a majority of the *met*-SWNTs while leaving a population of the *sem*-SWNTs in suspension, or precipitating a majority of the *sem*-SWNTs while leaving a population of the *met*-SWNTs in suspension. For this reason at least, the combination of Holzinger and the Haddon patents does not teach all elements of the claimed invention. Since the combination of Holzinger and the Haddon patents does not teach all elements

of the claimed invention Applicants believe that a *prima facie* case of obviousness has not been made. Applicant respectfully request reconsideration and withdrawal of the rejection of claims 1-4, 9-13 and 19-23.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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